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The Role of the Total-Quality-Management (TQM) Drivers in Overcoming the Challenges of Implementing TQM in Industrialized-Building-System (IBS) Projects in Malaysia: Experts' Perspectives

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Abstract: Total quality management (TQM) is a systematic management technique for developing a process-driven culture inside an organization to achieve quality and customer and employee satisfaction. TQM has started to impact global business systems, and is extensively regarded as a management "revolution". The implementation of TQM in the industrialized building system (IBS) in Malaysian projects has not been treated in much detail, although it is essential. This research intended to assess TQM adoption in IBS projects and identify how TQM drivers will help to overcome TQM-implementation challenges. This study utilized the mixed method by developing a semi-structured interview and survey, while the respondents were experts from TQM and IBS consulting firms. The content-validity approach was used, depending on 14 interviews and 28 responses to a distributed questionnaire. The findings indicate that TQM adoption of IBS projects is extremely poor. According to experts, local firms are still unable to execute TQM because they are reluctant to implement the TQM system as a strategy implementation across the construction process. Furthermore, according to the content validity ratio (CVR), there was an agreement that TQM would provide substantial benefits to IBS projects, such as offering cooperative associations, excellent communication, enhanced customer gratification, cost reductions, and productivity improvements. This study provided practical evidence of the fact that if the organizations adopted these 23 drivers of TQM they could overwhelm the challenges of TQM implementation in IBS projects. Thus, the stated factors were trustworthy, as indicated in the transcripts of interviews, and relying on the plurality of expert assessments. This study offers a valuable list of challenges and drivers for managers of the projects as guidelines to help them adopt TQM in IBS projects.

Keywords: total quality management (TQM); construction sustainability; TQM challenges; TQM drivers; TQM implementation; IBS; content-validity ratio; Malaysia

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1. Introduction

The key objective of every construction project is to meet the three fundamental criteria of cost, time, and quality [1,2]. Urbanization has grown rapidly for construction, resulting in a significant rise in resource development in many regions [3,4]. Since the early 1980s, quality management, also known as total quality management (TQM), has been an important focus for organisations, business administrators, academic scholars, and practitioners of industry [5]. Total quality management has been considered a vital successful implementation in the global construction industry. It has become a critical

tool for businesses worldwide to increase their competitiveness and deliver significant benefits [6]. TQM in the construction sector is primarily concerned with meeting the demands of the client, structural engineers, contractors, architects, and other construction players [7]. Construction quality management ensures that all phases of construction are completed following the needs of the project stakeholders [8]. TQM has been adopted in numerous organisations throughout the last several decades, to support quality and increase organisational effectiveness [9]. Therefore, the impact of TQM on the construction industry is to enhance quality, which is regarded as a worldwide phenomenon for achieving high production, despite rapid changes in environmental factors [10].

The industrialized building system (IBS) is a prospective prefabrication building approach that utilizes the finest construction machines, technology, resources, and detailed project preparation [11,12]. IBS construction is also recognized as offsite construction [13], prefabricated components [14], and modularization of construction [15] across the world [16]. Nowadays, Malaysia's construction sector is confronting significant challenges, since the conventional development paradigm, mainly fast expansion associated with high resource utilization, is unsustainable [17–19]. Lately, IBS has generated increasing attention, according to its characteristics of enhancing quality management, minimizing technical-labour force, saving construction time, and eliminating the waste of materials, etc. [20–22]. To understand the implementation of IBS in Malaysia, first, it is necessary to understand the Construction Industry Development Board (CIDB) as a governmental organisation that handles the framework of IBS in Malaysia [23,24].

Healthier quality in the construction industry is a renowned aspect of the performance and sustainability of projects carried out by the construction sector internationally [25]. The construction industry plays a crucial role in Malaysia's economy because of its contribution to economic growth, employment generation, and income production, all of which contribute to the country's gross domestic product (GDP) and financial progress [26]. The population of Malaysia is expected to surpass 35 million by 2025, resulting in an increasing need for construction [27]. According to the Department of Statistics of Malaysia, growth in the traditional construction industry decreased by 44.9 per cent in the second quarter of 2020, undermining the Malaysian government's target to develop one million houses for its residents [28]. It is fairly apparent that the conventional development technique can lead Malaysia's residence issue to arrive at a critical level, and a more competent construction approach is required [29]. The IBS projects in the Malaysian construction industry are known for their low productivity and high rates of project delays and cost overruns [30]. Thus, implementing TQM in IBS projects could potentially improve project outcomes by promoting a culture of quality and continuous improvement [31]. TQM has been widely adopted in various industries, such as manufacturing [32], healthcare [33,34] and education [35], but its implementation in the construction industry has not been extensively studied, particularly in the context of Malaysia. One potential reason for this gap in research is that the construction industry is highly complex and dynamic, with many unique challenges that may make it difficult to apply TQM principles.

Construction projects are typically characterized by uncertainty, rapidly changing conditions, and complex interactions among multiple stakeholders. These factors may make it difficult to implement TQM practices [36]. There is a need for further research to understand the specific challenges and opportunities associated with implementing TQM in this industry. Thus, this study aims to assess the role of the TQM drivers in overcoming the TQM challenges of TQM implementation in IBS projects. It also provides responses to concerns about the extra benefits TQM-adoption offers to the construction sector, such as what problems companies face when adopting TQM and the key success elements for accomplishing successful TQM implementation. This research is significant, because it adds to the body of knowledge and beneficial data acquired from IBS participants in the Malaysian construction sector. Furthermore, the present study enriches the existing literature by highlighting the relationship between TQM and IBS, which has been discussed from the perspective of experts in the Malaysian construction sector. In the following

sections, first, the literature review and research methodology are introduced, then, the result and discussion. A conclusion section is given at the end of this paper and, last but not least, future research directions are further proposed.

2. Literature Review

2.1. Total Quality Management

Project participants' quality requirements are changeable, and determined by their lives, preferences, beliefs, social systems, and education [37]. Today's scenario of fast technological progress and severe competition forces organisations to reconsider their tactics and strive to incorporate novel management concepts and solutions [38]. The principle of TQM is one of the most widely utilised concepts for managing the quality of products and services [39]. TQM has been embraced as a new strategy because of its broad application to management systems and processes; its adaptability has been expanded to manage environmental considerations, which have become increasingly vital for industries and the rest of nature all over the world [40]. Given the technical, political, financial, and environmental aspects that have transpired in recent decades, an organization's capacity to obtain and keep a significant advantage has become a serious issue [41].

TQM evolved as a consequence of quality evolution. The attention broadened to the quality of all concerns inside the company. The four stages of quality evolution include investigation, quality control, quality assurance, and TQM. TQM is an approach that aims to match quality output while meeting customer expectations. The level of quality in TQM is assessed by consumers [42]. Quality standards, such as the Deming Prize and the Malcolm Baldridge National Quality Awards (MBNQA) ISO 9000 series, outline the theories and values that include TQM [43–45]. The eight TQM concepts are summarised in Figure 1.

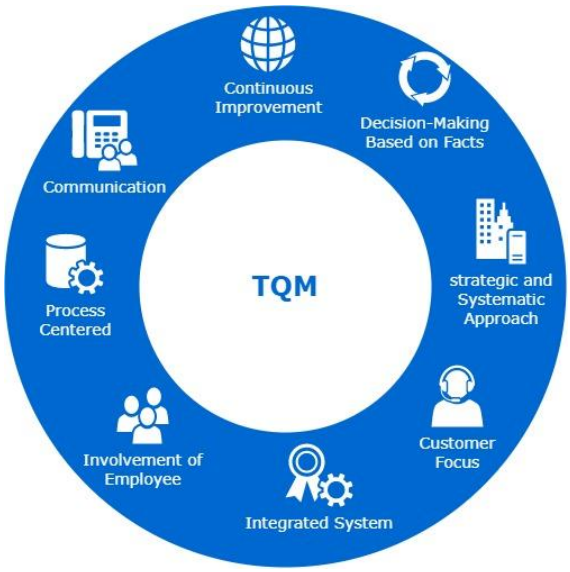

Figure 1. Principles of TQM.

There are several definitions of TQM, and they usually vary in which management responsibilities are included among the concepts [46]. The quality management system (QMS) is defined as the managerial structure, roles, methods, procedures, and management resources used to implement the guidelines and activity lines required to achieve a company's quality goals [46]. Additionally, it is a collection of quality actions performed throughout the creation of a product, procedure, or service, including protection and evaluation [47]. Furthermore, it is seen to be appropriate as a foundation for incorporating sustainability principles in sectors such as project development [48,49]. TQM enables each employee to have the chance to engage, serve and establish a sense of ownership and

responsibility [50]. Many studies have been conducted on the implementation of TQM, and it is considered that the advantages of increased customer satisfaction, higher-quality goods, and increased market share are frequently acquired after the deployment of TQM by construction organisations [51,52]. According to [53], people-related TQM becomes essential for both universities and people-related TQM practices. TQM is a strategy of constantly improving organisational quality that involves management, workers, consumers, and the business process in digital-based service firms [54]. Total quality management approaches have a considerable influence on the Social Security Corporation's knowledge-management process [55]. It demands a total shift in the business environment and management strategy from the conventional model of top management issuing instructions and people just accepting them [56].

To understand the significance of TQM and its effect, the advantages of TQM for the company must be understood [57]. A case-study investigation by Bardoel and Sohal [58] highlighted the advantages of TQM adoption in seven Australian construction firms. The stated benefits include improved process control, resulting in continuity from design to completion; a reduction in construction-process time; a decrease in the supply of products destroyed in transportation and construction; a diminished delivery schedule to the site; reduced chemical blowback; performance-improvement estimation; and improved customer expectations of the organisation [7]. It has had a tremendous influence on corporate success in several Western organisations, and has remained prominent in the business world since the 1990s [59]. Waldman states that, for organisations that embrace this management strategy, TQM provides greater quality and productivity, reduced waste, more production, and improved customer service [58].

Furthermore, several of the key advantages of a TQM programme, such as improved knowledge and the attention of all workers to meeting customer needs, have still not been realised in construction. Customer delight, fulfilling requirements, gaining a greater market share, improving efficiency, eliminating defects, increasing sales by X percent, and decreasing expenses by Y percent could all be accomplished by implementing TQM values into all elements of the organisation. The fact is that most corporations are far beyond getting the maximum advantages of quality standards [60]. The true benefit of implementing quality in the Malaysia construction industry are to increase operation and attain a particular degree of customer satisfaction [61,62].

2.2. Barriers to Total Quality Management

The construction sector tends to confound TQM with quality control (QC) and quality assurance (QA), assuming that adherence to QA standards such as ISO 9001 and 9002 is the extent of TQM's implementation on construction projects [63]. Due to this new misconception, both terms are now used similarly. Some construction issues, such as fluctuating demand and custom works (non-steady conditions), make TQM adoption challenging, and TQM can only assist organisations in dealing with such changes [64,65]. The barrier generated by traditional or conventional practice is one of the key obstacles hindering greater acceptance and adoption of TQM in the construction sector [66]. One example is the conventional method of evaluating project bids, which places the most focus on cost [67]. It is well known that the customer frequently chooses the contractor based mostly on cost, with little regard for prior experience, present workload, and reputation for excellence [64]. This scenario provides little motivation for contractors to implement TQM values.

TQM deployment in a company needs a fundamental organisational culture shift. Transforming a company's culture is challenging and frequently encounters reluctance [68]. The difficulty in adopting TQM arises from the belief that TQM is not a slogan, technique, or strategy; rather, it is an organisational philosophy [69]. TQM is a wide enough paradigm to serve as the framework or cornerstone of an organisation's culture [70]. Hence, adopting TQM may involve changing, rather than just altering, the firm's culture [71,72].

TQM implementation is one of the most difficult challenges for any organisation. Some companies find it difficult to adopt TQM effectively and satisfactorily; they also observe impediments or limitations that impede TQM adoption [73]. Because of these constraints, companies have not realised the anticipated advantages of adopting TQM [74]. Among several challenges in adopting TQM is the lack of a method for monitoring and controlling the overall progress of TQM adoption [75]. Furthermore, there is an inability to offer training skills just before the implementation of TQM [76]. Finally, considering TQM as an internal process and neglecting to include suppliers, subcontractors, and others in the system process makes TQM implementation very challenging [77].

2.3. Conceptual Framework

It is commonly acknowledged that several fundamental flaws hinder practitioners from becoming quality organisations; this, among other things, significantly impacts the industry's attractiveness. Construction firms' goals may vary, but the significance of customers is a shared concern. The capacity of construction firms to adapt to changing client needs is critical for long-term success. All firms, irrespective of their size or financial situation, are participants in the quality revolution; QM is regarded as being as crucial for small organisations as it is for big organisations, yet there are significant challenges limiting organisations from fully implementing TQM. The essence of the construction phase can occasionally be tracked to this issue. That is, projects are frequently extremely massive, labour intensive, and rarely located on the same site, the manpower is transient, and demand fluctuates, depending on the client's point of view of the value of the construction project. The invasive complexity, ambiguity, and instability of most construction projects challenge even experienced managers. As a result, construction projects are complex endeavours that necessitate coordinating the efforts of many people, each of whom brings their unique perspective and set of interests to the table. The project plan also tends to evolve several times throughout the construction process, which can cause delays and ultimately lower the quality of the finished product. The construction industry has been hesitant to embrace the comprehensive principle of TQM [78]. Following a similar trend, the construction sector has generally been resistant to change, but it is currently attempting to catch up with the TQM revolution that has transformed many companies [79]. One more barrier, described as ineffective or non-existent quality-management procedures, further clarified the fact that attaining reasonable levels of quality in the construction industry has long been an issue, due to the significant expenditure of time, finances, and materials, both material and human, wasted each year [80]. Consequently, based on the literature review, problem statement, and research gap, the conceptual framework of this study has been developed as illustrated in Figure 2.

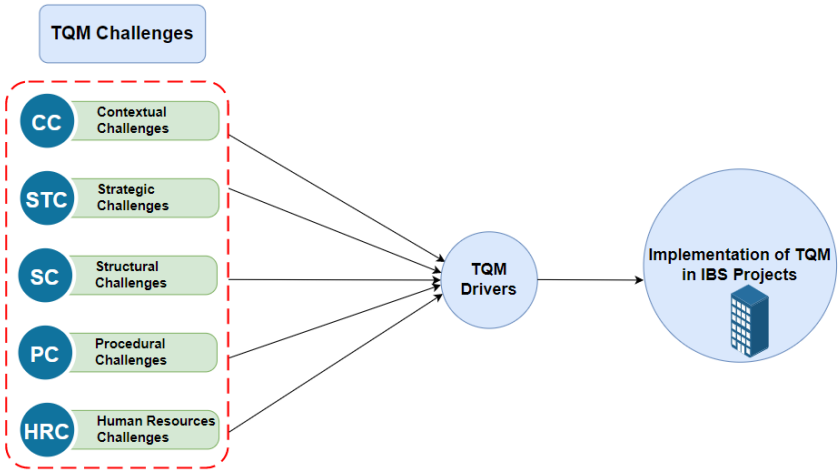

Figure 2. Conceptual Framework of Identified Relations Between TQM-Implementation Challenges and the IBS projects.

3. Research Methodology

The literature review was carried out to investigate the whole TQM adoption in IBS construction projects. As shown in Figure 3 as the research design, the data was acquired through books, scientific journals, international conference articles, governmental seminars sponsored by the Construction Industry Development Board (CIDB), an Industrialised Building System (IBS) centre, and resources accessible on the internet. After an extensive literature review, the study developed the data-collection instruments: interviews and a structured-survey questionnaire. A mixed-method approach was used to obtain information on TQM implementation in IBS building projects.

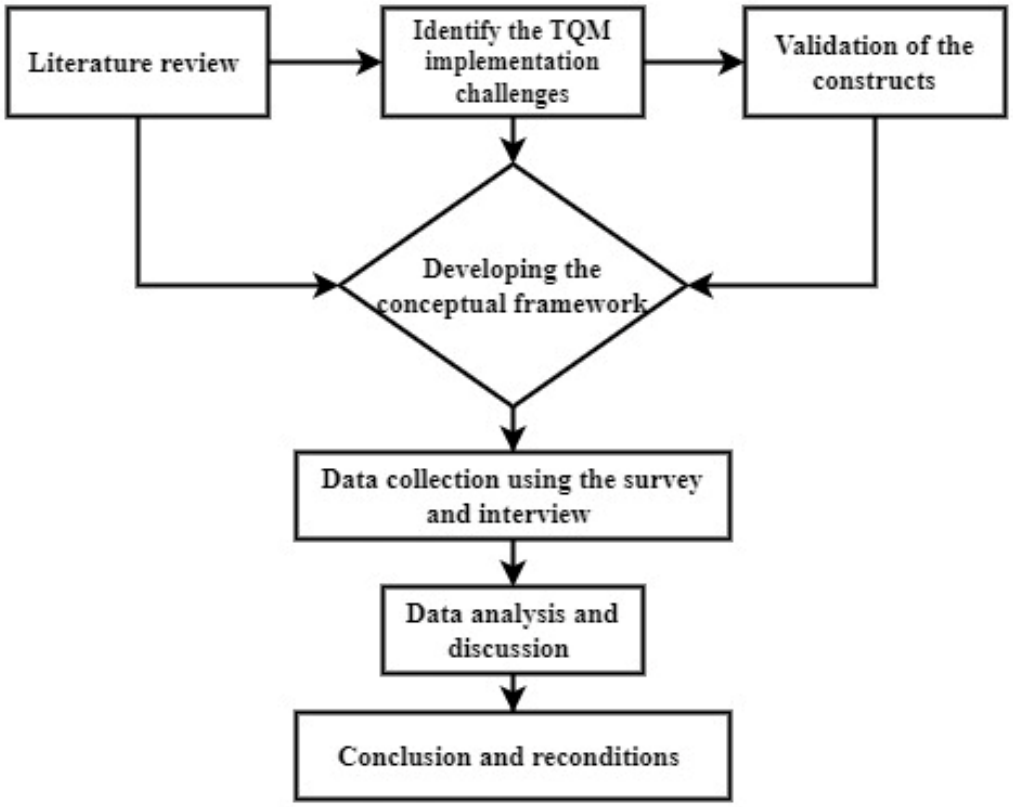

Figure 3. Research design.

Fifty-five TQM experts were called to the session for an interview and to verify the important variables for TQM benefits, challenges, and drivers in IBS construction projects. Prior studies have indicated that a sample size of 25 to 75 [81] or 15 to 35 [82] respondents are acceptable. Nevertheless, according to Sachs et al. [83], the sample size is influenced by the relevant subject, the kind of questionnaire survey, and the degree of input needed. Similarly, Shen, Q., Liu, G. [84], and Sachs et al. [83] utilised a sample size of 36 and 29, respectively. Mason [85] states that the saturating factor, in which new participants duplicate the same data, is critical in determining sample size for qualitative investigations. Only 42 respondents contributed to the invitation in this study, with 14 accepting the invitation for interview and 28 indicating their readiness to participate in a structured questionnaire for validity and judging. Hence, the following two steps of exploring the key factors were used in this study:

- Personal interview: Face-to-face and virtual sessions with 14 professionals who analysed qualitative data utilising thematic analysis [86]. The thematic-analysis approach was scrutinised in four major stages, as shown in Figure 4.
- Determining the range of overlapping: This made use of a panel for assessing content. The method utilises a content-evaluation panel of persons experienced in TQM imple-

mentation. The panel consists of 28 TQM experts who were selected to participate in a survey questionnaire. Each consultant obtained a set of items during the interview phase. Everyone was requested to individually contribute to the following question for each item: are the measurable benefit, difficulty, and success variables important for TQM application in IBS construction projects?

- Agree it is important;
- Perhaps valuable, but not important;
- Disagree: it is not needed.

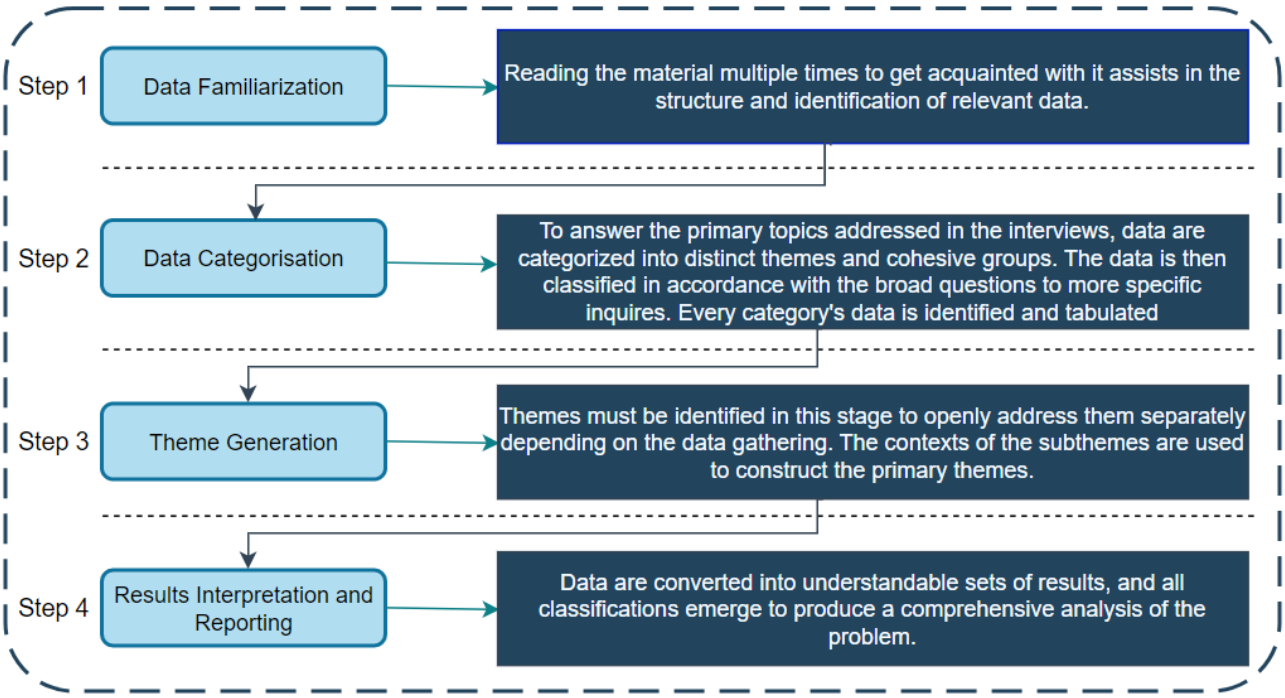

Figure 4. Thematic-Analysis Procedures.

After each section/theme, the experts involved were asked open-ended questions to allow them to express their perspectives in their own way. The comments of all experts were combined, and the number expressing "agree it is vital" for every item was obtained. Each of the following two hypotheses is supported by well-established principles of psychophysical science [81]:

- Any component whose behaviour is considered "significant" by more than 50% of the expert panel has some measure of content validity.
- The higher the proportion of the expert panel (more than 50%) who see the element as "significant," the higher the amount or level of its content validity.

With these hypotheses taken into account, the following formula was used for the content validity ratio (CVR) in this study. CVR is defined as a method that involves asking experts to judge whether the information or ability that each question on the questionnaire refers to is "important," "helpful, but not required," or "not essential [81,87–89]:

$$CVR = \frac{n_e - \frac{N}{2}}{\frac{N}{2}} \quad (1)$$

in which n_e is the number of experts who believe it is essential, and N represents the overall number of experts on the panels. CVR is a straight linear conversion of the proportion who agree it is essential.

1. Item selection: The CVR score is met for every item, according to the content assessment panel. To fulfil the 5% criterion, for instance, a CVR minimum of 0.49 is necessary. Only elements with CVR values that satisfy this requirement are maintained in the final version of the future concern. This premise is utilised because using the CVR to decline items does not prevent using a discrimination index or other standard item-analysis approach to choose further those questions to be maintained in the test's final structure [81,87,88].
2. The content-validity index (CVI):
   This reflects the extent to which believed excess arises between competence to perform in a specific TQM-implementation area and factors on the research under examination. Functionally, it is the averaged proportion of overlapping between the measurement items and the TQM-implementation domain [81].

4. Results and Discussion

The shift into a TQM company usually relies on the extent to which the organisations have effectively adopted quality management methods. Based on the content-validity approach, this study was designed to address a gap in the body of the literature regarding TQM adoption in various IBS projects in Malaysia, and to offer a complete list of TQM principles, barriers, and drivers of TQM implementation in IBS projects. The findings of this study will be revealed in the parts that follow:

4.1. Interview Analysis and Discussion

Table 1 illustrates the demographics of the construction professionals who participated in the interviews. They were chosen based on their experience and engagement in TQM and IBS construction projects. The fourteen construction specialists have TQM and IBS experience, varying from 6 to 20 years. Their engagement with TQM implementation was assessed as moderate, advanced, and professional, the latter indicating extreme consciousness of TQM implementation.

Table 1. Demography of Experts.

ID	Qualification	Designation	Experience (Year)	IBS Involvement (Year)	TQM Awareness
Ex1	PhD	Assoc. Prof	15	12	Considerably
Ex2	PhD	Professor	20	14	Considerably
Ex3	PhD	Professor	19	16	Considerably
Ex4	PhD	Assoc. Prof	18	15	Considerably
Ex5	PhD	Assoc. Prof	15	13	Considerably
Ex6	Master	IBS Player	10	8	Considerably
Ex7	Bachelor	IBS Player	8	7	Considerably
Ex8	Bachelor	IBS Player	5	4	Considerably
Ex9	Master	IBS Player	11	9	Considerably
Ex10	Master	IBS Player	9	8	Considerably
Ex11	Bachelor	IBS Player	13	11	Considerably
Ex12	Bachelor	IBS Player	10	8	Considerably
Ex13	Bachelor	IBS Player	7	6	Considerably
Ex14	Master	IBS Player	8	7	Considerably

Three key issues were established in this study: TQM implementation in IBS projects in Malaysia, barriers preventing local and small, and medium-sized enterprises (SMEs) from implementing TQM in their construction projects, and critical factors of effective TQM implementation in IBS projects.

4.1.1. TQM Implementation in IBS Projects

The overall assessment of TQM implementation was at level 0, "traditional level", and level 1, "modelling level." Furthermore, several professionals questioned believe that applying TQM in IBS projects in Malaysia has not reduced costs or time, and output remains poor, due to regulatory requirements. However, for development companies, TQM is not mandatorily needed, and TQM is applied only if the client requests it. On the other hand, few experts claim that the TQM philosophy is not addressed correctly and that what Malaysia is doing is simply the standard methodology, which is ranked as level 1. According to most experts, TQM implementation in IBS projects is the practice of monitoring construction projects effectively, which demands excellent communication. TQM is not widely used or implemented; some just simulate the construction aspects. TQM should be thoroughly implemented in IBS construction projects throughout the construction phase, along with the planning phase, project implementation, approval, and management. As a result, it is advised that organisations pledge to TQM adoption, begin implementing TQM procedures within their projects, and cooperate to effectively manage TQM initiatives. Motivation and dedication to TQM techniques are required for effective TQM-implementation improvement. Each division of the construction sector should be accountable for enhancing construction quality and improving worldwide efficiency.

Professionals were also questioned for their perspectives on TQM implementation in domestic and global companies, as well as the top firms and small and medium-sized firms, and to assess the various kinds of IBS construction projects with TQM adoption. The findings indicate that multinational organisations are often prepared to employ TQM in any kind of IBS project, since they have implemented the TQM approach and offer the necessary resources. Those companies are classified as successful companies. Domestic SMEs, on the other hand, are still not fully prepared for this transformation, since they lack the TQM approach owing to the initial expense and lack of cultural shift. The findings also show that when clients request TQM implementation, the majority of those firms use a third-party consultant to execute the TQM-process operations. Regarding TQM implementation in several sorts of IBS projects, the discourse indicated that TQM had been adopted in several towers and high-rise buildings within Kuala Lumpur, Selangor, Johor Bahru, and the Perak regions. Some clients may demand the implementation of the TQM process in medium- and low-rise buildings or apartments, but it is not common, since it is not mandatory, and therefore depends on the client's needs. The TQM system was considered valuable for all forms of IBS construction projects and useful to all construction players. Thus, local organisations must boost their utilisation of TQM in their construction projects.

4.1.2. Benefits of TQM Implementation in IBS Construction Projects

The significance of TQM has been highlighted in all aspects in recent years [90]. Organizations have extensively adopted TQM as a concept for ensuring the quality of products and services, efficiency, and customer satisfaction [91]. TQM is generally regarded by quality managers and experts as a quality strategy of management [6], and it has played an important role in the evolution of management practices [92]. TQM implementation in IBS projects will significantly benefit the construction sector and stakeholder interactions. TQM application results in increased customer satisfaction, cost reductions, and higher prestige for people and organisations, apart from the competition. The advantages of TQM implementation are obtained from previous studies [93,94]. Implementing TQM would improve selection potential during the tender process [95]. In this approach, TQM implementation helps reduce expenses, enhance revenues, and protect market dominance [96]. During the interview, these concepts were addressed by the professionals. Table 2 illustrates the group of items created after changing the proposed measure for TQM implementation.

Table 2. TQM-Implementation Benefits in IBS Projects.

ID	Benefits
TQMB1	TQM adoption will introduce companies to a different way of thinking about projects
TQMB2	Implementation of TQM significantly improves the efficiency of the IBS projects
TQMB3	TQM environments guarantee that proactive staff are suitably rewarded
TQMB4	Quality improvements should finally attempt to improve customer satisfaction in terms of acquiring information via surveys and feedback
TQMB5	Successful TQM adoption will result in cost savings
TQMB6	Increased overall project timeline
TQMB7	Members of the project team will be able to communicate more effectively
TQMB8	Reduction in workplace accidents, wastage, and poor manufacturing
TQMB9	Improved significant benefit and profitability

4.1.3. TQM Implementation Challenges in IBS Projects

TQM adoption demands modifications to the leadership context as well as the project-execution processes. Although the study highlighted TQM's importance in obtaining the greatest outcomes, it also identified the challenges that prevented efficient TQM implementation. According to the study, the most significant barriers to TQM adoption were poor-quality leadership, a lack of customer focus, poor-quality strategy, improper management of human resources, and insufficient collaboration. Moreover, these modifications will have an impact on the present organisational structure and work patterns, and the firm will need to become familiarised with the TQM process.

According to the literature-review assessment, players find a substantial barrier to using the system and gaining a greater understanding of TQM implementation. The difficulties were examined with the specialists in this area, and the relevant challenges were identified. TQM deployment in IBS projects is viewed as an unstable technique by most local firms, owing to the unpredictability of process changes and the expense of the TQM-system management procedure throughout the construction process. The most critical problem is understanding TQM techniques, since technology is always improving. Furthermore, it was stated that TQM has often needed teamwork among stakeholders, which is still a challenge in areas where people are more experienced in the conventional procedure of construction-project delivery. Individuals are hesitant to shift, and the industry is having difficulty persuading them.

Due to the unpredictability of construction-project needs in medium- and low-rise buildings, local SMEs have difficulty securing the preliminary cost of implementing the TQM system in their organisation. In this regard, top-management decision making amongst local stakeholders did not admit the implementation of TQM systems. Some professionals comment on the ambiguities of the communication process, which includes the TQM-system compatibility process. Developing personal and team enthusiasm to utilise TQM is also highlighted as one of the main problems of TQM implementation. Some experts have emphasised that few organisations are utilising TQM, and most construction companies are not adopting TQM, which is also a hurdle for TQM dissemination.

TQM adoption in IBS projects is hampered by local players' unawareness and lack of comprehension of the TQM system. Consequently, organisations should deliver enough training and improve the professional abilities needed to apply TQM. This has also been emphasised by Arditi et al. [97], as delivering extensive training programmes will promote TQM acceptance and productivity. According to Keinan et al. [98], providing more precise knowledge regarding TQM expenses and advantages would aid in providing sustainable structures.

4.1.4. Drivers of Successful TQM Implementation in IBS Projects

The significance of effective TQM implementation is reviewed with experts in this part; a thematic analysis was performed, to identify the critical drivers for successful TQM implementation in medium and low-rise construction IBS projects across Malaysian organisations. Before establishing the critical success variables, the experts thoroughly addressed several concerns. The following are the findings of the interview discussion.

TQM implementation relies on a common commitment from all parties involved. The lack of commitment of local organisations to TQM adoption in the IBS construction projects was emphasised. Professionals highlighted that, although requiring TQM implementation forces players to pledge their commitment, policymakers must also promote the implementation and integration procedures that minimise ambiguities in deploying new technologies in IBS construction projects. According to the literature, stakeholders' dedication is required to discover a mechanism to process and implement TQM in IBS construction projects [66]. Strategies can have an impact on the supply chain by encouraging innovation, enabling manufacturers to promote innovative ideas, and emphasising competitiveness in the market. Appropriate coordination across the supply network and within the essential role of the suppliers would result in frequent development [67]. According to some professionals, the construction-sector strategy substantially influences TQM adoption, since it directs project stakeholders towards optimal practices. The rules will assist companies' top-management decision making in becoming more dedicated to TQM implementation and increasing TQM deployment in IBS construction projects. Explaining responsibilities and restrictions will also establish a better working atmosphere. The policy may assist with TQM implementation by making it obligatory for all local organisations.

TQM adoption was viewed as an integrated process, involving individuals, procedures, and technology, in the context of IBS construction-project processing. From the design process through project completion, an efficient implementation strategy is employed to control construction performance effectively. People (the IBS contractor, IBS manager, consultant, and technician) are critical components in a TQM culture. They handle both the procedure and the technological depiction of the construction project. People plan the sequence of labour tasks and set a meaningful definition of the outputs and inputs of each step. Employees must have the necessary professional skills and understanding of the TQM process to provide effective and more-successful project delivery. Teamwork amongst SMEs in the TQM environment is essential in the IBS construction project. It contributes to improving project outcomes, having the correct mindset, and inspiring each team to ensure effective TQM adoption. The TQM implementation strategy should explicitly outline the process, instruments, degree of coordination and interaction, accountabilities, delivery and time frames. All these factors result in a more effective implementation of TQM.

4.2. Extent of Overlap and Judgment-Validity Measurement

This section aimed to assess the degree of overlapping and validate the retrieved elements discovered during the interviews. Data obtained from the interviews were recorded and then converted into the structured questionnaire for the professionals' judgement and analysing of the content validity ratio (CVR) for each element. If the judgement checklist disagreed with the importance of the element or factor assessed for successful TQM implementation, the relevant questions might be highlighted. Therefore, if the professionals agreed, we inferred that they were either "all incorrect" or "all correct." There was no foundation to question clear agreement, since they are specialists in TQM implementation in IBS construction projects. Depending on the situation, we could be certain that the factor was or was not genuinely crucial. When agreement was not reached, and the professional judgement was split fifty-fifty, issues occurred [81]. The outcomes of the interviewees are described in the sections below.

4.2.1. Lists of the Validity Panel's Demographic Profile

Table 3 describes the sample distribution and the background of respondents from the organisations where the study was performed. As shown in the table, the majority of participants (39%, n = 11) had a master's degree, followed by a bachelor's degree (32%, n = 9) as well as a PhD (28%, n = 8). According to Table 3, the majority of respondents in the sample (57%, n = 16) seemed to have more than 16 years of experience. According to Table 3, most of the respondents in the sample (57%, n = 16) seemed to have more than

16 years of experience. This is followed by less than 5 years' experience, from 5 to less than 10 years, 10–15 years, and more than 20 years with 7%, (n = 2), 5–10 years representing 14% (n = 4), 10–15 years representing 22% (n = 6), and more than 20 years representing 0% (n = 0). Regarding the nature of business (NOB), 39% (n = 11) are contractors, 25% (n = 7) are consultants, 29% (n = 8) are clients/developers, and 7%(n = 2) are others, including providers. In terms of position, construction-project managers have the highest representation (43%, n = 12), followed by site/residential engineers (25%, n = 7), and QS/planning engineers (18%, n = 5), and the smallest proportion represents junior managers (14%, n = 4). In terms of organisational type, it can be seen that the majority of respondents are from the private sector (61%, n = 17), followed by the public sector (36%, n = 10), and the fewest are in others (3%, n = 1). Finally, the table shows that the majority of respondents in the sample (43%, n = 12), have from 10 to less than 15 years of experience in IBS projects, followed by more than 20 years (28%, n = 8), from 5 to less than 10 years (18%, n = 5), and the lowest number (11%, n = 3) have from 1 to less than 5 years of experience.

Table 3. Demographic profile.

	Classification	Numbering	Proportion
Qualification	Ph.D.	8	28%
	Master's degree	11	39%
	Bachelor's degree	9	32%
Experience (Year)	Less than 5 years	2	7%
	From 5 to less than 10	4	14%
	From 10 to less than 15	6	22%
	From 15 to less than 20	16	57%
	More than 20 years	0	0%
Nature of Business	Contractor	11	39%
	Consultant	7	25%
	Client/Developer	8	29%
	Others	2	7%
Position	Site/Residential engineer	7	25%
	Construction-project managers	12	43%
	QS/Planning engineer	5	18%
	Junior managers	4	14%
Organisation Type	Public	10	36%
	Private	17	61%
	Others	1	3%
IBS involvement	1 to less than 5 years	3	11%
	5 to less than 10 years	5	18%
	10 to less than 15 years	12	43%
	More than 20 years	8	28%

4.2.2. TQM Implementation Benefits in IBS Projects

Total-quality-management approaches with decent principles have also been proven to have a favourable and substantial impact on IBS projects. By implementing TQM procedures, organisations can enhance their employees' knowledge and skills about the optimal use of resources. Employees are more energized and inspired when they operate in a workplace that assures their products and services provide outstanding value to society while also protecting the natural environment. Based on the findings of this study, if a company can properly manage its TQM operations, it will improve workers' skills, capacities, and desire to utilise materials effectively, resulting in increased efficiency. Table 4 illustrates the frequency (F) analysis of the list of TQM values in IBS projects. The highest number of respondents agreed with the TQM values stated in medium and low-rise IBS

projects. With CVR values of 0.357 and higher, there was consensus agreement on the values of TQM-system use in different IBS project classes. All values had a CVI of 0.516.

Table 4. Validity of Successful TQM-Implementation Benefit Analysis.

Item	Agree		Disagree		Perhaps		CVR
	F *	%	F	%	F	%	
TQM adoption	24	86%	1	4%	3	11%	0.714
Implementation of TQM	25	89%	2	7%	1	4%	0.786
TQM environment proactive employees	17	61%	5	18%	6	21%	0.214
Quality improvements	19	68%	2	7%	7	25%	0.357
TQM's success cost saving	23	82%	2	7%	3	11%	0.643
Overall increased project timeline	18	64%	6	21%	4	14%	0.286
Project-team communication	20	71%	5	18%	3	11%	0.429
Reduction of workplace	24	86%	1	4%	3	11%	0.714
Benefit and profitability	21	75%	0	0%	7	25%	0.500
CVR (Crucial) for a panel size (N) of 28 is 0.357 [97]						CVI	0.516

* F: Frequency.

According to the findings, TQM adoption is not only advantageous for massive projects but also for mid- and low-rise buildings. Thus, local organisations should commence using TQM technologies, and determine their issues and strengths to incorporate TQM into upcoming projects.

4.2.3. Challenges of TQM Implementation in IBS Projects

The construction sector tends to confound TQM with quality control (QC) and quality assurance (QA), assuming that adherence to QA standards such as ISO 9001 and 9002 is the extent of TQM's implementation on construction projects [63]. Due to this new misconception, both terms are now used similarly. Some construction issues, such as fluctuating demand and custom works (non-steady conditions), make TQM adoption challenging, and TQM can only assist organisations in dealing with such changes [64,65]. The challenges generated by traditional or conventional practice are one of the key obstacles hindering greater acceptance and adoption of TQM in the construction sector [66]. One example is the conventional method of evaluating project bids, which places the most focus on cost [67]. It is well known that the customer frequently chooses the contractor based primarily on cost, with little regard for prior experience, present workload, and reputation for excellence [64]. This scenario provides little motivation for contractors to implement TQM values.

TQM deployment in a company needs a fundamental organisational-culture shift. Transforming a company's culture is challenging, and frequently encounters reluctance [68]. The difficulty in adopting TQM arises from believing that it is not a slogan, technique, or strategy; rather, it is an organisational philosophy [69]. TQM is a wide enough paradigm to serve as the framework or cornerstone of an organisation's culture [70]. Hence, adopting TQM may involve changing, rather than just altering, the firm's culture [71].

TQM implementation is one of the most difficult challenges for any organisation [99]. Some companies find it difficult to adopt TQM effectively and satisfactorily; they also observe impediments or limitations that impede TQM adoption [100]. Because of these constraints, companies have not realised the anticipated advantages of adopting TQM [74]. Among several challenges in adopting TQM is the lack of a method for monitoring and controlling the overall progress of TQM adoption [75]. Furthermore, there is the inability to offer training skills just before the implementation of TQM [76]. Finally, considering TQM as an internal process and neglecting to include suppliers, subcontractors, and others in the system process makes TQM implementation very challenging [77].

Moreover, TQM is a dynamic process that needs reshaping and reorganizing of the construction procedure to handle numerous issues at every TQM-implementation stage.

Organizations and the construction sector confront significant hurdles in successfully transitioning from traditional to TQM technologies, and assigning funds and budgets. Construction stakeholders have implementation issues in determining when and where, as well as how, to adopt TQM. This article asserts that overcoming obstacles is necessary throughout TQM, highlighting 20 challenges that prevent local organisations from implementing TQM in IBS projects, as illustrated in Table 5.

Table 5. TQM-Challenges Validity Analysis in IBS Projects.

Construct	Element	Agree		Disagree		Perhaps		CVR	Source
		F	%	F	%	F	%		
Contextual challenges	Failure to modify organisational culture	22	79%	2	7%	4	14%	0.571	[101,102]
	Lack of departmental coordination	15	54%	2	7%	11	39%	0.071	[103,104]
	Indifference among team	17	61%	6	21%	5	18%	0.214	[78]
	Ineffective internal interaction	21	75%	5	18%	2	7%	0.500	[105]
Strategic challenges	Lack of quality leadership and planning	24	86%	0	0%	4	14%	0.714	[106–108]
	Shortage of top-management commitment	25	89%	1	4%	2	7%	0.786	[102,109]
	Awareness of customer demands and satisfaction	19	68%	4	14%	5	18%	0.357	[110,111]
	Change resistance in middle management	5	18%	17	61%	6	21%	−0.643	[112,113]
Structural challenges	Insufficient TQM awareness and information	23	82%	0	0%	5	18%	0.643	[114,115]
	Scarce funds for TQM and lack of customer focus	20	72%	2	7%	6	21%	0.429	[102,116]
	Ineffective organisational framework	16	57%	3	11%	9	32%	0.143	[10,117]
Procedural challenges	Lack of monitoring, assessment, and self-evaluation	18	64%	5	18%	5	18%	0.286	[102,118]
	Activities fragmentation	20	72%	2	7%	6	21%	0.429	[119]
	Quality-measurement constraints	17	61%	6	21%	5	18%	0.214	[120,121]
	Paperwork and bureaucracy	23	82%	0	0%	5	18%	0.643	[104,122]
Human-resources challenges	Insufficient human-resource improvement and administration	19	68%	1	4%	8	28%	0.357	[123,124]
	A scarcity of recognition and reward for success	18	64%	0	0%	10	36%	0.286	[115,121]
	Lack of management responsibility for the workforce's reluctance	22	79%	3	11%	3	11%	0.571	[102,125]
	A total absence of absolute top-management involvement	19	68%	3	11%	6	21%	0.357	[104,126]
	Inadequate preparation and lack of proper training	21	75%	3	11%	4	14%	0.500	[69,102,127]
CVR (Crucial) for a panel size (N) of 28 is 0. 357.						CVI		0.371	

4.2.4. Drivers of Successful TQM Implementation in IBS Projects

In the 1980s, among quality management operators, scientists, and consultants, a revolutionary idea known as total quality management emerged (TQM) [128]. TQM is described as a concept as well as a collection of guiding principles that serve as the cornerstone of a constantly improving company [129]. Over the last decade, several organisations have emphasised total quality management (TQM) to increase earnings, market dominance, and productivity, as seen in Table 6 [130]. Even though TQM is a proven technique for success in the construction industry, services, and manufacturing, numerous firms failed in their initiatives for various reasons, including a lack of senior management commitment, disregarding customers, and so on [131].

The current study explored the drivers and challenges associated with implementing TQM in IBS projects. Moreover, the study aimed to improve contextual understanding of how the stated drivers and challenges impact TQM implementation in various issues in IBS projects, as defined by the initial onset and level of TQM adoption in a firm. Based on the gathered literature on TQM integrated technologies and IBS on construction-progress observation, a conceptual framework on the topic of the IBS construction environment has been established, as illustrated in Figure 3. This framework intends to improve knowledge of both systems and operations, to effectively establish a TQM framework for progress detection using TQM-integrated technologies. Furthermore, this framework could be used

to analyse some of the challenges and drivers of efficient TQM implementation in the field of IBS performance assessment. Effective TQM adoption is heavily reliant on successful and effective top-management commitment, leadership, and communication channels with practitioners, operational technologies, and systems. However, the implementation of advanced technologies requires a high level of dedication and effective leadership, which proves to be a barrier to TQM adoption in IBS projects.

Table 6. TQM Drivers Validity Analysis in IBS Projects.

Item	Element	Agree		Disagree		Perhaps		CVR	Source
		F	%	F	%	F	%		
DF1	Top-management commitment	27	96%	0	0%	1	4%	0.929	[96,132]
DF2	Continual improvement	26	93%	0	0%	2	7%	0.786	[92,133]
DF3	Partnership and resources	19	68%	2	7%	7	25%	0.357	[134]
DF4	Quality data and reporting	21	75%	4	14%	3	11%	0.500	[135,136]
DF5	Supplier quality management	25	89%	1	4%	2	7%	0.786	[94,137]
DF6	Benchmarking	18	64%	5	18%	5	18%	0.286	[92,138]
DF7	Process management	22	79%	3	%	3	11%	0.571	[130]
DF8	Employee empowerment and participation	20	72%	2	7%	4	14%	0.429	[92,129]
DF9	Productivity and quality	17	61%	5	18%	6	21%	0.214	[133,137]
DF10	Process and user orientation	16	57%	4	14%	8	28%	0.143	[5,139]
DF11	Effective communication	23	82%	0	0%	5	18%	0.643	[7,140]
DF12	A strategic and systematic approach	19	68%	2	7%	7	25%	0.357	[141]
DF13	Teamwork and quality chain	26	93%	0	0%	2	%7	0.857	[142]
DF14	Coordination among project practitioners	23	82%	2	7%	3	11%	0.643	[36]
DF15	Customer satisfaction	27	96%	0	0%	1	4%	0.929	[143,144]
DF16	Decisions based on facts	20	72%	3	11%	5	18%	0.429	[145]
DF17	Positive leadership	24	86%	0	0%	4	14%	0.714	[132]
DF18	Information and analysis	18	64%	5	18%	5	18%	0.286	[94]
DF19	People management	22	79%	1	4%	5	18%	0.571	[146]
DF20	Training and development	20	72%	2	7%	6	21%	0.429	[135,147]
DF21	TQ and measurement	17	61%	5	%	4	14%	0.214	[7,138]
DF22	Quality aims and policy	22	79%	1	4%	5	18%	0.571	[57,133]
DF23	Resources, conservation and utilization	20	72%	2	7%	6	21%	0.429	[148]
	CVR (Crucial) for a panel size (N) of 28 is 0.357.					CVI		0.525	

5. Conclusions

This study examines the challenges and drivers of TQM implementation in IBS projects. Respondents were also carefully considered and came from the construction sector, with considerable relevant experience in TQM use in IBS projects. The results show that TQM drivers have a considerable and beneficial influence on IBS projects and can significantly improve construction-business processes. The findings also indicated that TQM adoption is significant amongst large-scale construction organizations, and TQM implementation is needed for massive IBS projects. Indeed, local companies are having difficulty adopting the TQM system and will be required to develop TQM technological and application abilities. Furthermore, depending on the CVR significance of 0.370, this study offers a key list of challenges and elements for success that should be addressed to resolve the key problem of poor TQM adoption in IBS projects. This paper contributes to studying TQM and IBS projects by presenting empirical evidence for an association between TQM and IBS-project practices and adaptability performance.

This current study has many practical and theoretical contributions. First, in terms of managerial contribution, this study is important for Malaysia's construction industry as a guide to achieve sustainability, particularly from the standpoint of construction experts. This study recommended that local and small and medium-sized firms commence TQM implementation and motivate experts to strengthen their TQM adoption abilities. The study concludes that implementing a TQM approach in IBS projects within an organizational

culture emphasizes TQM and builds a solid basis for a company's market competitiveness. Second, in terms of theoretical contribution, this paper contributes to extending the body of knowledge regarding TQM implementation and IBS projects by presenting empirical evidence for an association between TQM and IBS-project practices and adaptability performance. In addition, this study will help future researchers interested in implementing TQM in the construction industry.

Although this study has many contributions to make, there are still some limitations, including a limited data sample, the structure of a self-reported questionnaire, and a statistical-finding restriction. This study was carried out by utilizing a mixed method, which includes semi-structured interviews and a structured questionnaire based entirely on professionals with TQM-project experience, specifically in IBS projects, from the public and private sectors in Malaysia. As a consequence, the data were considered to be trustworthy, according to conducted interviews and expert perspectives. Future studies can obtain more data and utilize other construct measuring methodologies to conduct more analysis, to better understand the connection between TQM and other industries. In the future, it would be suitable to address a bigger sample of respondents in the same positions and with the same level of education, to increase the database and help to improve the quality of outputs. Additionally, future research should look at the correlation between the driving variables and TQM-adoption benefits. Likewise, investigating the aforementioned elements in other developing countries is valuable for TQM adoption in a global context. Furthermore, researchers may build on the quantitative findings of this study to undertake additional research utilising case studies, which would reveal more valuable workable implications for industrial organisations implementing TQM. Lastly, based on the findings discussed in this study, comparable investigations may implement and construct a framework for efficient TQM implementation.

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References

1. Zoghi, M.; Lee, D.; Kim, S. A computational simulation model for assessing social performance of BIM implementations in construction projects. *J. Comput. Des. Eng.* **2021**, *8*, 799–811. [CrossRef]
2. Erdogan, S.A.; Šaparauskas, J.; Turskis, Z. A multi-criteria decision-making model to choose the best option for sustainable construction management. *Sustainability* **2019**, *11*, 2239. [CrossRef]
3. Iqbal, Q.; Musarat, M.A.; Ullah, N.; Alaloul, W.S.; Rabbani, M.B.A.; Al Madhoun, W.; Iqbal, S. Marble Dust Effect on the Air Quality: An Environmental Assessment Approach. *Sustainability* **2022**, *14*, 3831. [CrossRef]
4. Baarimah, A.O.; Alaloul, W.S.; Liew, M.S.; Kartika, W.; Al-Sharafi, M.A.; Musarat, M.A.; Alawag, A.M.; Qureshi, A.H. A bibliometric analysis and review of building information modelling for post-disaster reconstruction. *Sustainability* **2022**, *14*, 393. [CrossRef]

5. To, W.M.; Yu, B.T.W.; Lee, P.K.C. How quality management system components lead to improvement in service organizations: A system practitioner perspective. *Adm. Sci.* **2018**, *8*, 73. [CrossRef]
6. Mazher, U.; Gharleghi, B.; Chan, B.; Fah, Y. A Study on the Factors Affecting Total Quality Management in the Saudi Arabian Construction Industry. *Int. J. Bus. Soc. Res.* **2015**, *5*, 30–40. [CrossRef]
7. Harrington, H.J.; Voehl, F.; Wiggin, H. Applying TQM to the construction industry. *TQM J.* **2012**, *24*, 352–362. [CrossRef]
8. Cleary, J.P.; Lamanna, A.J. Correlation of Construction Performance Indicators and Project Success in a Portfolio of Building Projects. *Buildings* **2022**, *12*, 957. [CrossRef]
9. Coelho, C.; Mojtahedi, M.; Kabirifar, K.; Yazdani, M. Influence of Organisational Culture on Total Quality Management Implementation in the Australian Construction Industry. *Buildings* **2022**, *12*, 496. [CrossRef]
10. Hoonakker, P.; Carayon, P.; Loushine, T. Barriers and benefits of quality management in the construction industry: An empirical study. *Total Qual. Manag. Bus. Excell.* **2010**, *21*, 953–969. [CrossRef]
11. Alawag, A.M.M.; Alaloul, W.S.; Liew, M.S.; Al-Bared, M.A.M.; Zawawi, N.A.W.A.; Ammad, S. *The Implementation of the Industrialized Building System in the Malaysian Construction Industry—A Comprehensive Review*; Springer: Singapore, 2021; ISBN 9789811607417.
12. Mohsen, A.; Yunus, R.; Handan, R.; Kasim, N.; Hussain, K. Determining factors for enhanced skilled worker requirements in IBS construction projects in Malaysia. *IOP Conf. Ser. Earth Environ. Sci.* **2019**, *220*, 012048. [CrossRef]
13. Nadim, W.; Goulding, J.S. Offsite Production in the UK: The Construction Industry and Academia. *Archit. Eng. Des. Manag.* **2009**, *5*, 136–152. [CrossRef]
14. Bari, N.A.A.; Abdullah, N.A.; Yusuff, R.; Ismail, N.; Jaapar, A. Environmental Awareness and Benefits of Industrialized Building Systems (IBS). *Procedia-Soc. Behav. Sci.* **2012**, *50*, 392–404. [CrossRef]
15. Ghannad, P.; Lee, Y.-C.; Choi, J.O. Investigating Stakeholders' Perceptions of Feasibility and Implications of Modular Construction-Based Post-Disaster Reconstruction. In Proceedings of the 2019 MOC Summit, Banff, AB, Canada, 21–24 May 2019; pp. 504–513. [CrossRef]
16. Alawag, A.M.; Alaloul, W.S.; Liew, M.S.; Al-Ashmori, A.; Alqadami, A.T.; Ammad, S. Application of Industrialised Building System in the Field of Construction toward Sustainability: Future Routes and a Theoretical Mapping. In Proceedings of the 2022 International Conference on Innovation and Intelligence for Informatics, Computing, and Technologies (3ICT), Sakheer, Bahrain, 20–21 November 2022; IEEE: New York, NY, USA, 2022; pp. 82–88.
17. Hussin, J.M.; Rahman, I.A.; Memon, A.H. The way forward in sustainable construction: Issues and challenges. *Int. J. Adv. Appl. Sci.* **2013**, *2*, 15–24. [CrossRef]
18. Noor, S.R.M.; Yunus, R.; Abdullah, A.H.; Nagapan, S.; Mazlan, S.M.S.S. Insights into the adoption of lean management in Industrialised Building System (IBS) implementation: The drivers and challenges. *Int. J. Eng. Technol.* **2018**, *7*, 22–31. [CrossRef]
19. Al-Aidrous, A.-H.M.H.; Shafiq, N.; Al-Ashmori, Y.Y.; Al-Mekhlafi, A.-B.A.; Baarimah, A.O. Essential Factors Enhancing Industrialized Building Implementation in Malaysian Residential Projects. *Sustainability* **2022**, *14*, 11711. [CrossRef]
20. Zhang, S.; Li, Z.; Ma, S.; Li, L.; Yuan, M. Critical Factors Influencing Interface Management of Prefabricated Building Projects: Evidence from China. *Sustainability* **2022**, *14*, 5418. [CrossRef]
21. Yunus, R.; Abdullah, A.H.; Yasin, M.N.; Hanipah, M.H. Examining Performance of Industrialised Building System (IBS) Implementation Based on Contractor Satisfaction Assessment. *ARPN J. Eng. Appl. Sci.* **2016**, *11*, 3776–3782.
22. Al-Aidrous, A.M.H.; Shafiq, N.; Rahmawati, Y.; Mohammed, B.S.; Al-Ashmori, Y.Y.; Baarimah, A.O.; Alawag, A.M. Major blocking factors affecting the application of industrialized building system. *Ain Shams Eng. J.* **2023**, 102151. [CrossRef]
23. Kasim, N.; Al-Sham, M.H.; Latiff, A.A.; Ibrahim, M.U.; Zainal, R.; Mohd Noh, H. Improving Contractors'Practices of Industrialized BuildingSystem (IBS) Implementation in Construction Industry. *J. Technol. Manag. Bus.* **2019**, *6*, 40–49. [CrossRef]
24. Kamaruddin, S.S.; Mohammad, M.F.; Mahbub, R. Barriers and Impact of Mechanisation and Automation in Construction to Achieve Better Quality Products. *Procedia-Soc. Behav. Sci.* **2016**, *222*, 111–120. [CrossRef]
25. Hussain, S.; Fangwei, Z.; Siddiqi, A.F.; Ali, Z.; Shabbir, M.S. Structural Equation Model for evaluating factors affecting quality of social infrastructure projects. *Sustainability* **2018**, *10*, 1415. [CrossRef]
26. Khan, R.A.; Liew, M.S.; Ghazali, Z. Bin Malaysian Construction Sector and Malaysia Vision 2020: Developed Nation Status. *Procedia-Soc. Behav. Sci.* **2014**, *109*, 507–513. [CrossRef]
27. Hakim, M.; Danial, B. Population Growth, Internal Migration and Urbanisation in Malaysia. Ph.D. Thesis, University of Liverpool, Liverpool, UK, 2019; pp. 1980–2040.
28. Saad, S.; Alaloul, W.S.; Ammad, S.; Altaf, M.; Qureshi, A.H. Identification of critical success factors for the adoption of Industrialized Building System (IBS) in Malaysian construction industry. *Ain Shams Eng. J.* **2022**, *13*, 101547. [CrossRef]
29. Azman, M.N.A.; Ahamad, M.S.S.; Majid, T.A.; Yahaya, A.S.; Hanafi, M.H. Statistical evaluation of pre-selection criteria for industrialized building system (IBS). *J. Civ. Eng. Manag.* **2013**, *19*, S131–S140. [CrossRef]
30. Alaloul, W.S.; Musarat, M.A.; Rabbani, M.B.A.; Iqbal, Q.; Maqsoom, A.; Farooq, W. Construction sector contribution to economic stability: Malaysian gdp distribution. *Sustainability* **2021**, *13*, 5012. [CrossRef]
31. Chin, K.S.; Pun, K.F. A proposed framework for implementing TQM in Chinese organizations. *Int. J. Qual. Reliab. Manag.* **2002**, *19*, 272–294. [CrossRef]
32. Garza-Reyes, J.A.; Yu, M.; Kumar, V.; Upadhyay, A. Total quality environmental management: Adoption status in the Chinese manufacturing sector. *TQM J.* **2018**, *30*, 2–19. [CrossRef]

33. Rawshdeh, M.; Keathley, H.; Obeidat, S.; Athamenh, R.; Tanash, M.; Hani, D.B. Factor Analysis of Quality Management Systems Implementation in Healthcare: An Online Survey. *Healthcare* **2022**, *10*, 1828. [CrossRef]
34. Yang, C.C. The establishment of a TQM system for the health care industry. *TQM Mag.* **2003**, *15*, 93–98. [CrossRef]
35. Sabet, H.S.; Saleki, Z.S.; Roumi, B.; Dezfoulian, A. A study on total quality management in higher education industry in Malaysia. *Int. J. Bus. Soc. Sci.* **2012**, *3*, 208–215.
36. Wawak, S.; Ljevo, Ž.; Vukomanović, M. Understanding the key quality factors in construction projects—A systematic literature review. *Sustainability* **2020**, *12*, 10376. [CrossRef]
37. Rajaratnam, D.; Jayawickrama, T.S.; Perera, B. Use of total quality management to enhance the quality of design and build projects. *Intell. Build. Int.* **2021**, *14*, 527–543. [CrossRef]
38. Borri, F.; Boccaletti, G. From total quality management to total quality environmental management. *TQM Mag.* **1995**, *7*, 38–42. [CrossRef]
39. Tamimi, N.; Gershon, M.; Currall, S.C. Assessing the Psychometric Properties of Deming's 14 Principles. *Qual. Manag. J.* **1995**, *2*, 38–52. [CrossRef]
40. Alawag, A.M.; Alaloul, W.S.; Liew, M.S.; Musarat, M.A.; Baarimah, A.O.; Saad, S.; Ammad, S. Critical Success Factors Influencing Total Quality Management In Industrialised Building System: A Case Of Malaysian Construction Industry. *Ain Shams Eng. J.* **2022**, *14*, 101877. [CrossRef]
41. Cancino, C.A.; La Paz, A.I.; Ramaprasad, A.; Syn, T. Technological innovation for sustainable growth: An ontological perspective. *J. Clean. Prod.* **2018**, *179*, 31–41. [CrossRef]
42. Topalović, S. The Implementation of Total Quality Management in Order to Improve Production Performance and Enhancing the Level of Customer Satisfaction. *Procedia Technol.* **2015**, *19*, 1016–1022. [CrossRef]
43. Flynn, B.B.; Schroeder, R.G.; Sakakibara, S. The Impact of Quality Management Practices on Performance and Competitive Advantage. *Decis. Sci.* **1995**, *26*, 659–691. [CrossRef]
44. Kin Chung, W. Benchmarking Singapore's high-TQM maturity organisations. *Benchmarking An Int. J.* **2001**, *8*, 8–35. [CrossRef]
45. Black, S.A.; Porter, L.J. Identification of the critical factors of TQM. *Decis. Sci.* **1996**, *27*, 1–21. [CrossRef]
46. Krajcsák, Z. Implementing open innovation using quality management systems: The role of organizational commitment and customer loyalty. *J. Open Innov. Technol. Mark. Complex.* **2019**, *5*, 90. [CrossRef]
47. Battikha, M.G. Quality management practice in highway construction. *Int. J. Qual. Reliab. Manag.* **2003**, *20*, 532–550. [CrossRef]
48. Aquilani, B.; Silvestri, C.; Ruggieri, A. Sustainability, TQM and value co-creation processes: The role of critical success factors. *Sustainability* **2016**, *8*, 995. [CrossRef]
49. Siva, V.; Gremyr, I.; Bergquist, B.; Garvare, R.; Zobel, T.; Isaksson, R. The support of Quality Management to sustainable development: A literature review. *J. Clean. Prod.* **2016**, *138*, 148–157. [CrossRef]
50. Alawag, A.M.; Salah Alaloul, W.; Liew, M.S.; Al-Aidrous, A.H.M.H.; Saad, S.; Ammad, S. Total Quality Management Practices and Adoption in Construction Industry Organizations: A Review. In Proceedings of the 2020 Second International Sustainability and Resilience Conference: Technology and Innovation in Building Designs, Sakheer, Bahrain, 11–12 November 2020. [CrossRef]
51. Abdallah, A.B.; Nabass, I.H. Supply chain antecedents of agile manufacturing in a developing country context: An empirical investigation. *J. Manuf. Technol. Manag.* **2018**, *29*, 1042–1064. [CrossRef]
52. Lehyani, F.; Zouari, A.; Ghorbel, A.; Tollenaere, M.; Sá, J.C. Knowledge Management and Total Quality Management Impact on Employee Effectiveness in Emerging Industries: Case of Tunisian Small and Medium Enterprises. *Sustainability* **2023**, *15*, 3872. [CrossRef]
53. Cobelli, N.; Bullini Orlandi, L.; Burro, R. People-related TQM practices: The role of metaperceptions. *TQM J.* **2022**, *34*, 165–178. [CrossRef]
54. Schiavone, F.; Pietronudo, M.C.; Sabetta, A.; Ferretti, M. Total quality service in digital era. *TQM J.* **2022**, *34*, 165–178. [CrossRef]
55. Al Shraah, A.; Abu-Rumman, A.; Al Madi, F.; Alhammad, F.A.F.; AlJboor, A.A. The impact of quality management practices on knowledge management processes: A study of a social security corporation in Jordan. *TQM J.* **2022**, *34*, 605–626. [CrossRef]
56. Quazi, H.A.; Padibjo, S.R. A journey toward total quality management through ISO 9000 certification—A study on small- and medium-sized enterprises in Singapore. *Int. J. Qual. Reliab. Manag.* **1998**, *15*, 489–508. [CrossRef]
57. Bouranta, N.; Psomas, E.L.; Pantouvakis, A. Identifying the critical determinants of TQM and their impact on company performance: Evidence from the hotel industry of Greece. *TQM J.* **2017**, *29*, 147–166. [CrossRef]
58. Bardoel, E.A.; Sohal, A.S. The role of the cultural audit in implementing quality improvement programs. *Int. J. Qual. Reliab. Manag.* **1999**, *16*, 263–277. [CrossRef]
59. Waldman, D.A. A theoretical consideration of leadership and total quality management. *Leadersh. Q.* **1993**, *4*, 65–79. [CrossRef]
60. Janipha, N.A.I.; Ismail, F. Conceptualisation of Quality Issues in Malaysian Construction Environment. *Procedia-Soc. Behav. Sci.* **2013**, *101*, 53–61. [CrossRef]
61. Mohammad, M.Z.; Viana, M.; Raghib, A.T. Benefits and implications of the different types of quality management in the Malaysian construction industry. *IOP Conf. Ser. Mater. Sci. Eng.* **2019**, *650*, 012008. [CrossRef]
62. Kiew, P.N.; Ismail, S.; Yusof, A.M. Integration of quality management system in the Malaysian construction industry. *J. Organ. Manag. Stud.* **2016**, *2016*, 267–274. [CrossRef]
63. Jaafari, A. Management of risks, uncertainties and opportunities on projects: Time for a fundamental shift. *Int. J. Proj. Manag.* **2001**, *19*, 89–101. [CrossRef]

64. Shang, G.; Sui Pheng, L. Barriers to lean implementation in the construction industry in China. *J. Technol. Manag. China* **2014**, *9*, 155–173. [CrossRef]
65. Albalkhy, W.; Sweis, R. Barriers to adopting lean construction in the construction industry: A literature review. *Int. J. Lean Six Sigma* **2021**, *12*, 210–236. [CrossRef]
66. Zeng, S.X.; Wang, H.C.; Zeng, S.X.; Wang, H.C.; Tam, C.M.; Deng, Z.M. The rise and fall of total quality management in the chinese construction industry. *Archit. Sci. Rev.* **2003**, *46*, 105–113. [CrossRef]
67. Gilchrist, A.; Allouche, E.N. Quantification of social costs associated with construction projects: State-of-the-art review. *Tunn. Undergr. Sp. Technol.* **2005**, *20*, 89–104. [CrossRef]
68. Hauder, M.; Roth, S.; Matthes, F.; Schulz, C. Organizational factors influencing enterprise architecture management challenges. In Proceedings of the 21st European Conference on Information Systems (ECIS), Utrecht, The Netherlands, 5–8 June 2013.
69. Huq, Z. Managing change: A barrier to TQM implementation in service industries. *Manag. Serv. Qual.* **2005**, *15*, 452–469. [CrossRef]
70. Kujala, J.; Ullrank, P. Total Quality Management as a Cultural Phenomenon. *Qual. Manag. J.* **2004**, *11*, 43–55. [CrossRef]
71. Schneider, B.; Brief, A.P.; Guzzo, R.A. Creating a climate and culture for sustainable organizational change. *Organ. Dyn.* **1996**, *24*, 7–19. [CrossRef]
72. Lakhe, R.R.; Mohanty, R.P. Total quality management: Concepts, evolution and acceptability in developing economies. *Int. J. Qual. Reliab. Manag.* **1994**, *11*, 9–33. [CrossRef]
73. Nenadál, J.; Vykydal, D.; Tylečková, E. Complex customer loyalty measurement at closed-loop quality management in B2B area—Czech example. *Sustainability* **2021**, *13*, 2957. [CrossRef]
74. Fatemi, S.M.; Wei, C.C.; Fatemi, S.S. Total Quality Management (TQM) Implementation Barriers in Organizations. Available online: https://www.sid.ir/paper/933195/en (accessed on 29 January 2023).
75. Talib, F.; Rahman, Z.; Qureshi, M. Analysis of interaction among the barriers to total quality management implementation using interpretive structural modeling approach. *Benchmarking* **2011**, *18*, 563–587. [CrossRef]
76. Yusuf, Y.; Gunasekaran, A.; Dan, G. Implementation of TQM in China and organisation performance: An empirical investigation. *Total Qual. Manag. Bus. Excell.* **2007**, *18*, 509–530. [CrossRef]
77. Pheng, L.S.; Ke-Wei, P. A framework for implementing TQM in construction. *TQM Mag.* **1996**, *8*, 39–46. [CrossRef]
78. Femi, O.T. Barriers and Benefits of Total Quality Management in the Nigerian Construction Industry: A review. *Int. J. Eng. Work.* **2015**, *2*, 7–13. [CrossRef]
79. Al-Khalifa, K.N.; Aspinwall, E.M. The development of total quality management in Qatar. *TQM Mag.* **2000**, *12*, 194–204. [CrossRef]
80. Al Salihi, R.A.; Ghasemlounia, R. Total Quality Management Benefits and Barriers in Construction Industry. *SSRN Electron. J.* **2021**, *11*, 193–199. [CrossRef]
81. LAWSHE, C.H. a Quantitative Approach To Content Validity. *Pers. Psychol.* **1975**, *28*, 563–575. [CrossRef]
82. Fowler Jr, F.J.; Cosenza, C. Design and evaluation of survey questions. *SAGE Handb. Appl. Soc. Res. Methods* **2009**, *2*, 375–412.
83. Sachs, T.; Tiong, R.; Qing Wang, S. Analysis of political risks and opportunities in public private partnerships (PPP) in China and selected Asian countries: Survey results. *Chinese Manag. Stud.* **2007**, *1*, 126–148. [CrossRef]
84. Lin, Y.C.; Lin, L.K. Critical success factors for knowledge management studies in construction. In Proceedings of the 23rd International Symposium on Automation and Robotics in Construction 2006 (ISARC 2006), Tokyo, Japan, 3–5 October 2006; pp. 768–772. [CrossRef]
85. Mason, M. Sample size and saturation in PhD studies using qualitative interviews. *Forum Qual. Sozialforsch.* **2010**, *11*. [CrossRef]
86. Vaismoradi, M.; Turunen, H.; Bondas, T. Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. *Nurs. Health Sci.* **2013**, *15*, 398–405. [CrossRef]
87. Ayre, C.; Scally, A.J. Critical values for Lawshe's content validity ratio: Revisiting the original methods of calculation. *Meas. Eval. Couns. Dev.* **2014**, *47*, 79–86. [CrossRef]
88. Wilson, F.R.; Pan, W.; Schumsky, D.A. Recalculation of the critical values for Lawshe's content validity ratio. *Meas. Eval. Couns. Dev.* **2012**, *45*, 197–210. [CrossRef]
89. AL-Ashmori, A.; Dominic, P.D.D.; Singh, N.S.S. Items and Constructs of Blockchain Adoption in Software Development Industry: Experts Perspective. *Sustainability* **2022**, *14*, 10406. [CrossRef]
90. Zhang, B.; Comite, U.; Yucel, A.G.; Liu, X.; Khan, M.A.; Husain, S.; Sial, M.S.; Popp, J.; Oláh, J. Unleashing the importance of tqm and knowledge management for organizational sustainability in the age of circular economy. *Sustainability* **2021**, *13*, 11514. [CrossRef]
91. Phan, A.C.; Nguyen, H.T.; Nguyen, H.A.; Matsui, Y. Effect of total quality management practices and jit production practices on flexibility performance: Empirical evidence from international manufacturing plants. *Sustainability* **2019**, *11*, 3093. [CrossRef]
92. Antunes, M.G.; Mucharreira, P.R.; Justino, M.R.T.; Texeira-Quirós, J. Effects of total quality management (Tqm) dimensions on innovation—Evidence from smes. *Sustainability* **2021**, *13*, 10095. [CrossRef]
93. Bhat, K.S.; Rajashekhar, J. An empirical study of barriers to TQM implementation in Indian industries. *TQM J.* **2009**, *21*, 261–272. [CrossRef]
94. Nguyen, M.H.; Phan, A.C.; Matsui, Y. Contribution of quality management practices to sustainability performance of Vietnamese firms. *Sustainability* **2018**, *10*, 375. [CrossRef]

95. Haupt, T.C.; Whiteman, D.E. Inhibiting factors of implementing total quality management on construction sites. *TQM Mag.* **2004**, *16*, 166–173. [CrossRef]
96. Khalil, M.K.; Muneenam, U. Total quality management practices and corporate green performance: Does organizational culture matter? *Sustainability* **2021**, *13*, 11021. [CrossRef]
97. Arditi, D.; Gunaydin, H.M. Total quality management in the construction process. *Int. J. Proj. Manag.* **1997**, *15*, 235–243. [CrossRef]
98. Keinan, A.S.; Karugu, J. Total Quality Management Practices and Performance of Manufacturing Firms in Kenya: Case of Bamburi Cement Limited. *Int. Acad. J. Hum. Resour. Bus. Adm.* **2018**, *3*, 81–99.
99. Cândido, C.J.F.; Santos, S.P. Is TQM more difficult to implement than other transformational strategies? *Total Qual. Manag. Bus. Excell.* **2011**, *22*, 1139–1164. [CrossRef]
100. Dilawo, R.S.; Salimi, Z. Understanding TQM implementation barriers involving construction companies in a difficult environment. *Int. J. Qual. Reliab. Manag.* **2019**, *36*, 1137–1158. [CrossRef]
101. Shibani, A.; Saidani, M.; Gherbal, N. An Evaluation of Obstacles Preventing Implementation of TQM in Libyan Organisations. *Bus. Manag. Res. J.* **2012**, *1*, 84–91.
102. Kigozi, E. Challenges to Successful Implementation of Total Quality Management (TQM) in Education Institutions: A Case of Selected Primary Teacher Training Colleges (PTTCs) in Uganda. *Int. J. Innov. Res. Educ. Sci.* **2019**, *6*, 429–433.
103. Kumar, R. Analysis of Total Quality Management (TQM) Barriers on its Performance using TOC. *Int. J. Res. Appl. Sci. Eng. Technol.* **2019**, *7*, 665–670. [CrossRef]
104. Kumar, V.; Verma, P.; Mangla, S.K.; Mishra, A.; Chowdhary, D.; Chi Hsu, C.H.; Lai, K.K. Barriers to Total Quality Management for sustainability in Indian organizations. *Int. J. Qual. Reliab. Manag.* **2020**, *37*, 1007–1031. [CrossRef]
105. Sarhan, J.; Xia, B.; Fawzia, S.; Karim, A.; Olanipekun, A. Barriers to implementing lean construction practices in the Kingdom of Saudi Arabia (KSA) construction industry. *Constr. Innov.* **2018**, *18*, 246–272. [CrossRef]
106. Sebastianelli, R.; Tamimi, N. Understanding the Obstacles to TQM Success. *Qual. Manag. J.* **2003**, *10*, 45–56. [CrossRef]
107. Shameer, D.; Sing, C. Barriers to total quality management (TQM)-Implementation in the Mauritian food industry. In Proceedings of the 11th International Conference on Manufacturing Research (ICMR2013), Cranfield, UK, 19–20 September 2013; pp. 611–616.
108. Omer, M.M.; Mohd-Ezazee, N.M.A.; Lee, Y.S.; Rajabi, M.S.; Rahman, R.A. Constructive and Destructive Leadership Behaviors, Skills, Styles and Traits in BIM-Based Construction Projects. *Buildings* **2022**, *12*, 2068. [CrossRef]
109. Talib, F.; Rahman, Z. Identification and prioritization of barriers to total quality management implementation in service industry: An analytic hierarchy process approach. *TQM J.* **2015**, *27*, 591–615. [CrossRef]
110. Abdirad, H.; Nazari, A. Barriers to effective implementation of quality management systems in public design projects in Iran. *Archit. Eng. Des. Manag.* **2015**, *11*, 457–474. [CrossRef]
111. Abdullah, N.L.; Jamaludin, K.R.; Talib, H.H.A. Jurnal Teknologi Full paper Challenges of Quality Management: A Case Study at Malaysian Electronics Manufacturing Services Company. *ResearchGate* **2015**, *59*, 29–32.
112. Al-Mekhlafi, A.-B.A.; Isha, A.S.N.; Abdulrab, M.; Ajmal, M.; Kanwal, N. Moderating effect of safety culture on the association inter work schedule and driving performance using the theory of situation awareness. *Heliyon* **2022**, *8*, e11289. [CrossRef] [PubMed]
113. Purwaningrum, E.K.; Suhariadi, F. Fajrianthi Participation and Commitment to Change on Middle Managers in Indonesia: The Role of Perceived Organizational Support as Mediator. *Glob. Bus. Rev.* **2020**, *23*, 1218–1235. [CrossRef]
114. Ngai, E.W.T.; Cheng, T.C.E. Identifying potential barriers to total quality management using principal component analysis and correspondence analysis. *Int. J. Qual. Reliab. Manag.* **1997**, *14*, 391–408. [CrossRef]
115. Ngwenya, B.; Sibanda, V. Challenges and benefits of total quality management (TQM) implementation in manufacturing companies: A case study of delta beverages, in Zimbabwe The Impact of Multi-Currency System on the Viability of the Zimbabwean Hospitality System View project. *Int. J. Orig. Res.* **2016**, *2*, 296–307.
116. Jaeger, M.; Adair, D. Perception of TQM benefits, practices and obstacles: The case of project managers and quality management representatives in Kuwait. *TQM J.* **2016**, *28*, 317–336. [CrossRef]
117. Bajaj, S.; Sethi, M.; Khurana, M. Classification of TQM Barriers for TQM Implementation in Steel Industries: A Review and Analysis. *Int. J. Eng. Manag. Res.* **2017**, *7*, 235–245.
118. Pussella, H.D.M.M.; Yapa, S.T.W.S. Barriers in Implementing Total Quality Management in Organizations: A Literature Review. *Proc. Int. Conf. Bus. Manag.* **2021**, *17*, 1333–1347. [CrossRef]
119. Thakkar, J.; Deshmukh, S.G.; Shastree, A. Total quality management (TQM) in self-financed technical institutions: A quality function deployment (QFD) and force field analysis approach. *Qual. Assur. Educ.* **2006**, *14*, 54–74. [CrossRef]
120. Bravi, L.; Murmura, F.; Santos, G. The ISO 9001:2015 quality management system standard: Companies' drivers, benefits and barriers to its implementation. *Qual. Innov. Prosper.* **2019**, *23*, 64–82. [CrossRef]
121. Aghimien, D.; Aigbavboa, C.; Thwala, W.; Mothiba, H. Total Quality Management Practices in Construction Project Delivery in South Africa. *IOP Conf. Ser. Mater. Sci. Eng.* **2019**, *640*, 012004. [CrossRef]
122. Polat, G.; Damci, A.; Tatar, Y. Barriers and benefits of total quality management in the construction industry: Evidence from Turkish contractors. In Proceedings of the Seventh Research/Expert Conference with International Participation Quality, Helsinki, Finland, 14–16 November 2011; Citeseer: Princeton, NJ, USA, 2011; pp. 1115–1120.
123. Rahman, M.N.A.; Shokshok, M.A.; Wahab, D.A. Barriers and benefits of total quality management Implementation in Libyan manufacturing companies. *Middle-East J. Sci. Res.* **2011**, *7*, 619–624.

124. Raghavendra, A.N.; Nijaguna, G.; Batchu, D. Implementation challenges of Total Quality Management (TQM) in dairy sector. *SMART J. Bus. Manag. Stud.* **2019**, *15*, 1–9. [CrossRef]
125. Prajogo, D.I.; McDermott, C.M. The relationship between total quality management practices and organizational culture. *Int. J. Oper. Prod. Manag.* **2005**, *25*, 1101–1122. [CrossRef]
126. Pambreni, Y.; Khatibi, A.; Ferdous Azam, S.M.; Tham, J. The influence of total quality management toward organization performance. *Manag. Sci. Lett.* **2019**, *9*, 1397–1406. [CrossRef]
127. District, K.; Suleman, Q. Challenges to Successful Total Quality Management Implementation in Public Secondary Schools: A Case Study of. *J. Educ. Pract.* **2015**, *6*, 123–135.
128. Ehigie, B.O.; McAndrew, E.B. Innovation, diffusion and adoption of total quality management (TQM). *Manag. Decis.* **2005**, *43*, 925–940. [CrossRef]
129. Chang, D.S.; Sun, K.L. Exploring the correspondence between total quality management and Peter Senge's disciplines of a learning organization: A Taiwan perspective. *Total Qual. Manag. Bus. Excell.* **2007**, *18*, 807–822. [CrossRef]
130. Seetharaman, A.; Sreenivasan, J.; Boon, L.P. Critical success factors of total quality management. *Qual. Quant.* **2006**, *40*, 675–695. [CrossRef]
131. Jehangiri, R. Identification of Critical Success Factors for Total Quality Management Implementation in Organizations. *Int. J. Econ. Manag. Sci.* **2017**, *6*, 8–11. [CrossRef]
132. Reinaldo, L.D.S.P.; Vieira Neto, J.; Goyannes Gusmão Caiado, R.; Gonçalves Quelhas, O.L. Critical factors for total quality management implementation in the Brazilian construction industry. *TQM J.* **2020**, *33*, 1001–1019. [CrossRef]
133. Ismail Salaheldin, S. Critical success factors for TQM implementation and their impact on performance of SMEs. *Int. J. Product. Perform. Manag.* **2009**, *58*, 215–237. [CrossRef]
134. Shanmugapriya, S.; Subramanian, K. Ranking of key quality factors in the Indian construction industry. *Int. Res. J. Eng. Technol.* **2015**, *2*, 907–913.
135. Kr Singh, R. Analyzing the interaction of factors for success of total quality management in SMEs. *Asian J. Qual.* **2011**, *12*, 6–19. [CrossRef]
136. Beshah, B.; Berhan, E. Critical success factors for TQM implementation. *Int. J. Product. Qual. Manag.* **2017**, *21*, 490–499. [CrossRef]
137. Sader, S.; Husti, I.; Daróczi, M. Industry 4.0 as a key enabler toward successful implementation of total quality management practices. *Period. Polytech. Soc. Manag. Sci.* **2019**, *27*, 131–140. [CrossRef]
138. Talib, F.; Rahman, Z. Critical success factors of TQM in service organizations: A proposed model. *Serv. Mark. Q.* **2010**, *31*, 363–380. [CrossRef]
139. Kumar, R.; Mishra, R.S. Linking TQM Critical Success Factors to strategic goal: Impact on Organizational Performance. *IOSR J. Mech. Civ. Eng.* **2020**, *17*, 1–13. [CrossRef]
140. Nikolić, M.; Cerić, A. Classification of Key Elements of Construction Project Complexity from the Contractor Perspective. *Buildings* **2022**, *12*, 696. [CrossRef]
141. Unzueta, G.; Esnaola, A.; Eguren, J.A. Continuous improvement framework to develop cultural change: Case study, capital goods company. *TQM J.* **2020**, *32*, 1327–1348. [CrossRef]
142. Al Nahyan, M.T.; Abdel All, S.F. Key Enablers of Effective Implementation of TQM in Royal Jet Airways. *Adv. Decis. Sci.* **2017**, *2017*, 3197585. [CrossRef]
143. Kim, G.S. The effect of quality management and Big Data management on customer satisfaction in Korea's public sector. *Sustainability* **2020**, *12*, 5474. [CrossRef]
144. Khanam, S.; Talib, F.; Siddiqui, J. Identification of total quality management enablers and information technology resources for ICT industry: A Pareto analysis approach. *Int. J. Inf. Qual.* **2015**, *4*, 18–41. [CrossRef]
145. Baran, E.; Polat, T.K. Classification of Industry 4.0 for Total Quality Management: A Review. *Sustainability* **2022**, *14*, 3329. [CrossRef]
146. Lau, A.W.T.; Tang, S.L.; Li, Y.S. The level of TQM application by construction contractors in Hong Kong. *Int. J. Qual. Reliab. Manag.* **2015**, *32*, 830–862. [CrossRef]
147. Gunasekaran, A. Enablers of total quality management implementation in manufacturing: A case study. *Total Qual. Manag.* **1999**, *10*, 987–996. [CrossRef]
148. Izvercian, M.; Radu, A.; Ivascu, L.; Ardelean, B. The Impact of Human Resources and Total Quality Management on the Enterprise. *Procedia-Soc. Behav. Sci.* **2014**, *124*, 27–33. [CrossRef]